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ABSTRACT

As a compulsory part of the study in Pedagogical Information Science at the University of Bergen and Stord/Haugesund College (Norway) during the spring term of 1999, students participated in a distributed group activity that provided experience on distributed collaboration and use of online groupware systems. The group collaboration process was mediated by information and communication technology, and the work was done on the presumption that each group member had access to his own computer. The groups collaborated through the network by means of a groupware program called TeamWave Workplace, a program that offers the participants a joint workspace and tools that allow users to collaborate, show and exchange files, have common databases, write/draw on the same screen, etc. The assignment was to create a room in TeamWave Workplace that enables learning of a specific subject. This paper presents a theoretical framework of Computer Supported Collaborative Learning (CSCL) and findings--both challenges and crucial elements--based on participation in this open, distributed, and collaborative learning environment. (Contains 18 references.) (MES)

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Challenges of Using CSCL in Open Distributed Learning

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Abstract: The role of the teacher is changing. The teacher is to be the one who organizes the entire learning environment. Real-time educational groupware systems allow geographically separated learners to work together in a shared virtual workspace at the same time. There has been a move from teaching to learning. As a compulsory part of the MEd in Pedagogical Information Science at the University of Bergen and Stord/Haugesund College in the Spring term of 1999, the students participated in a distributed group activity. In this paper we present some of our findings,- both challenges and decisive elements, based on our participation in this open, distributed and collaborative learning environment.

Introduction

Recent research draws attention to a change in the role of the teacher. The teacher is no longer an information-transmitter who transfers his own knowledge into the minds of the pupils. The new teacher role is instead defined more like an information organizer and adapter. The teacher is to be the one who organizes the entire learning environment. The expansion of the Internet and computers as a means of communication, have since the late 1980s opened for widespread research on different models of distributed collaborative learning. The introduction of recent technology, in particular computer-supported tools in education, has during the last 40 years gone through a number of paradigm shifts (Koschman, 1996). Tapscot (1997) describes these shifts as a change from *broadcast* to *interactive* learning. Thus, there has been a move from teaching to learning, where the roles of the actors on the learning arena have become more equal. The emerging area of theory, which several researchers are concerned with, is referred to as Computer Supported Collaborative Learning (CSCL).

Our Theoretical Framework of Computer Supported Collaborative Learning

The development within research on learning through collaboration has experienced a shift from focusing on the individual in the group (1970-80) to studying the entire group as a whole (Koschmann, 1996). Research on CSCL (Koschman, 1996) focuses on instruction as practice rather than lecturing. Focus is on the process rather than on the result. Theories are based on observed situations, and the tendency is that CSCL is based on a descriptive method, as opposed to a more experimental form of work. In addition, attention is on understanding the process from the participants' point of view. It is important to focus on the single factors, and try to understand the role of these factors in the process of collaboration, so-called process oriented focus. This, however, demands brand new tools for analysis and modeling of collaboration (Dillenbourg et al., 1996).

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ICT-based collaborative learning has emerged from several theories of learning: *Social Constructivism*, focusing on the development of the individual, based on social interaction (Bauersfeld, 1995). *Soviet's Sosio-Cultural theories*, focusing on the cultural environment for understanding the actions of the individual. Furthermore it is claimed that learning rises on two different levels, first, at the inter - psychological level, and second, on the intra - psychological level (Wertsch, 1985). *Situated/distributed cognition*, emphasizing on the concrete situations and environments where learning takes place (Lave & Wenger, 1991). In addition, this theoretical framework contains a mutual understanding of language, culture, and other aspects of the social relations (Scott, Cole & Engel, 1992).

The process of learning in such an environment is based on collaborative learning. Collaborative learning can be defined in several ways. Bruffee (1993, p. 3) describes collaborative learning as "a reculturative process that helps students become members of knowledge communities whose common property is different from the common property of the knowledge communities they already belong to". Roschelle and Behrend (1995, p. 70), on the other hand, define collaborative learning as "the mutual engagement of participants in a co-ordinated effort to solve [a] problem together".

In designing new information- and communication technology mediated forms of open distributed learning (ODL) environments, the expression *collaborative telelearning* (Wasson, 1998) is commonly used. Rather than explaining the expression distance only to aspects of time and space, as we know it from traditional ODL, we want the mediation of learning activities to be supported by i.e. *multimedia shared workspaces*. CSCL and collaborative telelearning use means that emphasize ICT as mediating tools in collaborative situations. Such a tool should contain mechanisms for supporting synchronization, exchange and sharing of information and documents. Access to tools and services should be as transparent as possible to avoid obstacles in the learning process. A distributed collaborative learning environment is a place that is being constructed by the participating students through individual and collaborative work. The role of the designer will be to support the students in the process of creating this environment in such a manner that the computer system becomes an integrated part of the student activity.

Our Experience

As a compulsory part of the study in Pedagogical Information Science at the University of Bergen and Stord/Haugesund College during the Spring term of 1999, the students participated in a distributed group activity. The activity, which was part of the DoCTA (1999) project, was to provide experience on distributed collaboration and use of online groupware systems. The University of Bergen, Nord-Trøndelag College, Stord/Haugesund College and Telenor Research & Development participated in the project. In practice this meant that students in each group came from different geographical places and technical environments.

The entire group collaboration process was to be mediated by information- and communication technology. The work was done on the presumption that each group member had access to his or her own computer. The groups were to collaborate through the network by means of a groupware program called TeamWave Workplace (1999). This program offers the participants a joint workspace. The workspace is defined as a room. One great advantage in Team Wave is that it is based on the *place* metaphor with its persistence, and not on a

meeting metaphor like many other groupware systems. The participants may create their own rooms, and navigate between the different rooms by using the doorways provided in the room. In each room there are a number of available tools. By means of these tools the group members can collaborate, show and exchange files and URLs, have common databases, address books and calendars, may write and draw on the same screen etc. In a room of TeamWave, participants can see who else is logged in and what room they are in. They can also observe each other's cursors and observe each other create, delete or move objects in the room.

The task of the students in this assignment was to create a room in TeamWave Workplace, which enables learning of a specific subject. The work process of the group was made up by several stages. After the group had installed and made the program work on their computers, a rehearsal stage started. In this session the students were led through a number of assignments where the underlying goal was to provide experience in using the tool and practicing interaction with the rest of the group, and simultaneously getting to know their fellow students. The main part of the activity was the design activity. The group was to design a room in TeamWave where students can learn a specific topic with theory, procedure, process etc. Throughout the collaboration, focus was directed towards the actual collaboration process within the design group. The main interest of the activity was on how students made their decisions and how they were carried out, rather than on the final contents of the learning room that was designed.

Challenges

It is a great challenge to create successful collaborative situations in a classroom. When participants in addition seek to transfer this workform to an ICT based environment in order to build what is referred to as CSCL, the task becomes even more complex. In such a situation the composition and orchestrating of the entire working environment will, according to Salomon (1992), be more important than the design of the technology. In a computer supported collaborative learning environment Salomon (1992) identifies two effects connected to the learning design. He chooses to distinguish between *effect with CSCL;* changes that take place while one is engaged in intellectual partnership with peers or with a computer tool, and *effect of CSCL;* more lasting changes that take place as a consequence of the intellectual partnership. This is the lasting cognitive result, defined as being more general than the previous. Seen from a perspective of learning the natural choice will be to emphasize and increase the *effect of CSCL*. Thus one may train for independent thinking for use in unforeseen circumstances where technology is unavailable. However, taking Vygotskys (1978) thoughts of *zone of proximal development* into consideration, and his theories of how social interaction creates cognitive changes, one should also consider the *effect with* factor.

By concentrating on the totality of the learning situation, focus will also be on the environment surrounding the pupils, the actual work process and the technical profit. Due to the fact that the student primarily manages the process of working on a PC, learning becomes more a process of active construction of knowledge than simple acquisition of facts. In order to strengthen and maintain effective CSCL, motivation and engagement from the participants are important. This is what Salomon (1992) describes *as mindful engagement*. Although the students are sincerely engaged this does not always lead to effective and adequate collaboration. To increase the quality of the collaborative process Salomon (1992) sketches a

need for *genuine and necessary context* or *genuine interdependence* between the participants. The decisive factors that this expression consists of are the need for *sharing necessary information, division of labor between the participants* and *joint thinking*, thinking in explicit terms that can be considered, adjusted and prepared by the other members. However the computer itself cannot create these effects. The development of knowledge demands a motivated engagement in a social process of acquiring opinions. This stresses that the environment is designed as a well-combined entity.

Salomon ascertains that group collaboration cannot fully function if the process consists solemnly of division of labor and individual work. He therefore stresses the fact that participants require engagement and a joint platform to base the tasks upon. In order to build this common point of departure the participants will need to share information. The fact that information is only presented in written form can clearly be seen as a weak point, considering that tone of voice and gestures disappear. It is difficult to know how much to write either by e-mail or chat modus. Being capable of producing a clear and concise message by means of only few words is a clear strength in the use of written text on the computer screen. The groupware programs which are used today for educational purposes enable students to work together, regardless of time and geography, in a common virtual room. For the present, however, the systems are not as good as face-to-face learning situations.

The success of a method of collaboration depends, as mentioned above, on the engagement of all involved parties. In an opening phase it will thus be important that the design allows and the teacher manages to motivate and activate the students. Throughout the process the role as an evaluator will also become more and more relevant. Thus it can be claimed that all these different roles are necessary for creating successful and efficient collaborative learning. In order to maintain activity and engagement among the pupils, attention is drawn to other decisive factors in addition to the evaluator function. In an early stage of the development of distributed learning using ICT, the use of e-mail has been important, especially in computer mediated communication. Internet students have sent e-mail to their supervisors and fellow students, and received response and comments on the contents of their message. Seen from a behaviourist learning perspective this form of communication may have been satisfactory.

The last few years, studies have been performed on different net based forms of collaborative work. In these studies (Koschman, 1996; Dillenbourg et al., 1995) a more socio-cultural learning paradigm is chosen as point of departure. There is emphasis of the context, environment and culture surrounding the learner. In addition there is also a tendency to increase focus on the activity of the individual as a framework for learning. Both constructivists and those who support activity-theory try to create healthy learning environments by placing the activity in the center of attention. One has focused on creating a social network around the participating students. Although students are placed at separate computers in different geographical areas, it is important to provide the students with the feeling of not being alone. This leads up to the conclusion that use of e-mail communication only, is not satisfactory. Based on this theoretical framework, Goldman (1992) has studied student behavior and divided them into three categories used as a starting point for further analysis: *social-, task- and conceptual interactions*. In a distributed learning environment the participants should build up a shared understanding and knowledge within these fields. Have the participants the same understanding of the social context? How are the connections between the participators? How is the work task interpreted and solved? How does a particular activity or piece of knowledge fit into the existing pattern of knowledge? In order to work efficiently and create an environment that encourages collaborative learning, the groupware program should contain functions providing the participants with such knowledge. In addition to these elements Gutwin et al. (1995) introduces what they refer to as *workspace awareness*. This expression embraces up-to-the-minute knowledge about the group members and the shared workspace. This expression is presented for two reasons. First, it will reduce the distance and differences in the level of knowledge between the collaborating members and enable them to act more naturally and efficiently, and second, it makes the students more capable of engaging in practices where collaborative learning may arise.

Among students in a traditional collaborative environment there are several mechanisms, which creates learning environments:

- Students frequently tempt to model their skill and knowledge to their fellow students

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- Learning arises through identification and finding solutions to distinctions between crossing ideas and theories
- Peer teaching, where one student instructs and assists another where needed
- Construction of new, shared hypotheses

How can we transfer these mechanisms to a distributed ICT-mediated learning environment? The most important reason why these methods work as a means of learning in a face-to-face situation is that they enable students to take notice of and observe each other, and see with their own eyes how fellow students work. They can study each other's methods in order to copy or correct them later. In a traditional collaborative situation these factors are taken for granted. This may explain why this part so far has experienced weak support in existing GroupWare programs. Based on Gutwin et al.'s (1995) argumentation we see that it is necessary to work out knowledge about fellow students in the work field. From a visual point of view, enabling the students to observe each other's cursors and movements performed by fellow students in the workspace solves this. The use of *workspace awareness* as a starting point also makes it possible to make use of artifacts as conversing objects. This is done when the object is visible for all parties.

There are advantages with the function presented above, but you will eventually encounter the question of where to draw the line. How many details should be revealed? Will I always know everything about everybody? Could observations of what fellow students do, and incoming messages hamper and confuse my own work? Gutwin et al. (1995) propose to define two stages: task stage and work space stage. If several people are working simultaneously in the same room, it is often a great advantage to be able to observe who the other persons are. At the same time you may want to work alone without being interrupted in the task stage. How can you as a participant manage this? One of the main aspects presented by Gutwin et al. (1995) is that students should be able to peek over each others shoulder to observe what they are doing. But, as mentioned above, you may wish to work undisturbed. It is important that the program used also supports this choice, unless you plan to perform such operations in other environments. Especially when it comes to awareness concepts, but also when talking about genuine interdependence, we should be aware of the fact that the net-generation will develop a whole new attitude to virtual rooms and worlds compared to what adults ever will. This is why it may not be necessary to write or show everything about everybody, but rather leave to the students to find out on their own.

> *The written word, on the other hand, brings out images and metaphors that draws its material from the readers imagination and experiences. When we read a novel we provide the colors, sounds and movements ourselves. I believe the same form of personal supply is needed in order to understand what being digital means to ones own life* (Negroponte, 1995, p. 13)[1]

Crucial Elements Noticed

It is almost impossible to achieve full effect of CSCL without total engagement from the participants. Within several of our groups there were signs of lacking motivation among the participants. Salomon (1992) argues that we are dependent on seeing the totality of the learning session, "the curriculum, the activities that students engage in, students' perceptions of the learning goals in the classroom, their social interactions, the (p. 63). We agree that the totality of the learning situation plays a decisive role on the educational profit of the CSCL-activity. It is easier to create engagement if the task is significant. When working with learning activities in the classroom we quite often experience receiving feedback on whether the activity is good or meaningful. Usually the teacher is present and visits the group every now and then, or may be called upon to comment on the work. In a number of other educational situations one also experiences being corrected and followed up by a teacher. This can be found in professional working life as i.e. the method of

[1] Translated from the Norwegian edition.

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cognitive apprenticeship (Brown et al., 1989). In connection with the expression *awareness*, together with response and facilitation from teachers and others, the students experienced a lack of feedback on their work. How can we see who has been in the room and observed our work? -When were they there and how did they appreciate our work? This could be compared to the inspiration of being peeked over the shoulder in the classroom, it does, however, assume that you know who it is and what their reactions are.

To what extent the students know each other, is also an important factor that will influence the process of collaboration. In the activity referred to in this paper, the students did not know each other. This was reflected in the method used in solving the task. The method was influenced by the fact that everybody did something, and then we discussed what we had done. The discussion was influenced by the fact that the participants did not know each other, and it takes time to get to know each other. Perhaps we were too insecure? It probably takes far more time than we had at hand to establish the necessary contact. This caused difficulties in creating an honest engagement among the participants.

Seen from our experience, *genuine interdependence* is important, perhaps even more important than *workspace awareness*. Knowing people's strengths and weak points, in addition to their being engaged, becomes important elements in the process. Nevertheless we do not neglect what an influential role *workspace awareness* serves in strengthening the engagement and the division of information that Salomon points out. Motivation and engagement regarding the work performed in such CSCL-environments will be connected to the concrete piece of work that is given. In addition, it is therefore significant that the participants experience a feeling of actually performing something of importance in order to achieve a proper result. Otherwise the actual activity will have to be inspiring enough to make the participants wish to finish the task. Based on these experiences we find it necessary to point out that the significance and functionality of a program is strongly dependent on the type of work and the task a group has been assigned with.

In the use of CSCL and telelearning it is important to look for methods for contextualizing a subject, creating more vivid descriptions and closer relations to common practice. Although the software used in our design activity has proven to contain certain weak points, we consider ICT and groupware programs like i.e. Team Wave Workplace to be a useful aid and tool for achieving this goal. The advantage of this usage is that it involves the user in constructing his or her own learning environment. In this way Tapscots (1997) wish for a shift in the learning situation from *broadcast* to *interactive learning* is getting closer to reality.

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